

Novel methods for simulating relativistic systems using an optimal boosted frame

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It was shown recently that it may be computationally advantageous to perform computer simulations in a Lorentz boosted frame for a certain class of particle acceleration devices or problems such as: free electron laser, laser-plasma accelerator, and particle beams interacting with electron clouds*. However, even if the computer model relies on a covariant set of equations, it was pointed out that algorithmic difficulties related to discretization errors may have to be overcome in order to take full advantage of the potential speedup**. Further complications arise from the need to transform input and output data between the laboratory frame and the frame of calculation, but can be overcome at low additional computational cost***. We will present the theory behind the speed-up of numerical simulation in a boosted frame, our latest developments of numerical methods, and examples of application to the modeling of the above-cited problems and others if applicable.

*J.-L. Vay, *Phys. Rev. Lett.* **98**, 130405 (2007)

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